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The cuts illustrating this article show fronds about $\frac{1}{2}$ th their normal size. The figures indicate normal forms. Letters indicate marked variations.

MANLIUS, N. Y.

Experiences with a Fern Garden--III

C. L. GRUBER

The boulder fern has not yet entered upon an era of prosperity in my fern garden. Although the rootstock rambles away a short distance each summer and each spring, about April 30, sends up a few fronds, these fronds do not reach the height which is attained in their native habitats and seem to grow more as a special favor to me than from an inclination to establish themselves permanently. Probably the character of the soil is not adapted to more thrifty growth, but I have not yet taken sufficient time to experiment in this respect.

In August, 1912, I planted one maidenhair fern on the fern bed and a row of five along the wall on the northeast side of the cellar containing the heating-furnace. The plant on the fern bed grew poorly and died in 1914; but the row along the warm cellar wall grew luxuriantly and developed into the finest bank of maidenheads I have ever seen. For a foot or more from the wall the ground does not freeze up as it does further away; and as a result the ferns begin to grow somewhat earlier in spring than they do in a wild state. Most of the first fronds, and a large percentage of all the fronds are fertile. The plant on the fern bed began growing on April 16, but those along the house appeared from April 5 to April 10; and the dark brown sporangia ripened during the first week in July, later fronds maturing their fruit till the close of August or the beginning of September. In 1915 most of the fronds were over a foot in height by April 25.

I transferred a number of sensitive ferns from the border of a marsh to a corner of my fern bed in August, 1911. The sterile fronds came up in spring from April 25 to May 4, but the drier situation retarded their subsequent growth considerably. Sterile fronds continued to appear, in favorable years, during June and July, and it required some vigilance to prevent their spreading into forbidden domains. In 1916, however there was an abundance of rain, the sterile fronds grew to normal size, and this year, for the first time, fertile fronds were produced. These appeared early in July and by the close of July had attained their full size, just about reaching or partly entering the leafy canopy spread over and among them. At the present time, January, 1917, the rolled-up "berries" inclosing the silvery brown sporangia are still closed and will probably not release their contents until the coming of the spring time.

I experienced some rather interesting failures in trying to induce the walking fern to grow. Plants set in the fern bed rarely lasted longer than a year. In September, 1914, I made another determined effort, based on lines of experience and observation. In the shade of Goldie's shield fern I prepared a special dwelling place for these fastidious dwellers of the rocky ledges. Thin, flat plates of limestone were set in an inclined position into a hollowed out part of the bed, layers of woods mold were placed between these plates, and in one of the crevices the roots of a clump of walking ferns were firmly planted. At last I had found the way of doing it. The walking ferns grew and reached out and took root and continued to grow, starting new fronds in spring during the first days of May; and today, without more attention than providing water during dry spells, I have a flourishing colony of these fascinating ferns.

My one experience with the hart's-tongue fern, although interesting, was rather discouraging. I bought

one of these ferns in May, 1911, and planted it in my fern bed. It produced a number of fronds and grew finely in 1911, but remained dormant throughout 1912. Then, on July 21, 1913, it began to send up two very small fronds—and ever since it has failed to make its appearance, dead, by this time, without a doubt.

In August, 1914, I planted six adder's tongues in the fern bed. Five of these appeared in 1915 during the last days of April. In 1916 they did not come up till the middle of May, two of them with fertile spikes. Both of these fertile plants were eaten off near the base during the night while still quite young and in June each of them produced a small sterile blade.

The results of my efforts to grow club-mosses, *Lycopodium obscurum* and *Lycopodium lucidulum*, can be summed up in one statement—complete failure to keep them growing for a longer period than two years. It is my experience that the *Lycopodiums* and probably one or more species of ferns must be provided with the natural soil of their habitats, or with special plant food, to make them grow well. My experience with the mountain laurel and trailing arbutus tends to prove this supposition to be correct. For a number of years I had tried to grow mountain laurels in my yard, but from one to three years was the limit of their existence. Then I tried the plan of filling the hole in which I planted the laurel with the ground which I dug out while securing the plant, mixing the portion above the roots with a liberal supply of half-rotted oak leaves and mulching it thickly with the same material. Each year I furnish it with a supply of decaying oak leaves and for five years my mountain laurel has been growing fairly well.

In general, the dates of the appearance in spring and of the fruiting of wild ferns correspond well with these same periods of growth of the ferns in my fern garden.

Of course, location has a great deal to do with these stages and may change the date by a week or even two.

Some species of ferns wither with the first frosts or soon after the freezing nights of October have set in; but others are decidedly evergreen or have a tendency in this direction. During the last week in November, 1914, the species of ferns still entirely green were the marginal shield fern, spinulose shield fern, the sterile fronds of the crested fern, the polypody, cliff brake, dwarf spleenwort, ebony spleenwort, especially the sterile fronds, walking fern, and Christmas fern, and the grape ferns of course were beautifully bronzed. Goldie's shield fern still was green, but the fronds were drying and apparently frozen. The male fern and obtuse woodsia had a few green fronds, mainly the younger ones, most of those of the male fern being dark bronze; and a small number of maidenhair fronds also were green but drying.

In spring, about the beginning of April, I remove rubbish and superfluous covering from the fern bed, cut off the dead and imperfect fronds, fasten the plants lifted by freezing, and give them other attention that may be necessary.

On March 27, 1915, when I attended to this annual house-cleaning, the marginal shield fern, polypody, dwarf spleenwort, Christmas fern, cliff brake, walking fern, and the grape ferns were still entirely green or almost so. The sterile fronds and a few of the fertile fronds of the ebony spleenwort and most of the sterile fronds of the crested fern were still green. A majority of the fronds of the spinulose shield fern, especially the latter ones or those protected by leaves, were green and fresh in appearance. Even a few fronds of obtuse woodsia, sheltered by leaves, were green, but several erect fronds, which evidently had remained green while drying, were dead and brittle. A few fronds of Goldie's

shield fern still had green patches and one frond, protected by the leaf-covering, was green and living.

Among the curiosities developed in the fern garden were a forked frond of the silvery spleenwort, a forked and crested frond of the marginal shield fern, and several forked fronds of the New York fern.

KUTZTOWN, PA.

Notes and News

In the course of a collecting trip made through Curry County, Oregon, in June, 1917, in company with Professor M. E. Peck of Willamette University, we were fortunate enough to find a very beautiful *Adiantum* which was determined by Mr. J. Francis Macbride of the Gray Herbarium as *A. Jordani* Mueller. The specimen was growing in very dry rocky soil on the north side of the canyon of Rogue River, a few miles below the mouth of Mule Creek, near the deserted mining camp of Solitude Bar. As this species is not mentioned in Professor Sweetser's "Popular Description of the Common Oregon Ferns" (1913), and no specimen of it is included in the herbarium of the University of Oregon, I was inclined to think at first that this was its first occurrence in the State. The range given in Eaton's *Ferns of North America* (I, 286), where it is described as *A. emarginatum* Hook., is "From San Diego, California, to Oregon"; but no specimen to confirm its occurrence in this State is cited. There is, however, in the herbarium of the University of California a specimen collected by Thomas Howell "in the Umpqua Valley, June 20, 1887." Since Eaton's first volume appeared in 1879, this specimen of Howell's cannot be the authority on which Eaton based his reference of the species to Oregon. I can find no collector who has seen it here recently. My own specimen